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Waste Minimization—A Case Study

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ABSTRACT

As the regulations governing the storage, treatment, and disposal of regulated waste become more stringent in an attempt to minimize any potential adverse effect of wastes on the environment, so have industries' approaches to minimizing its production and disposal of such waste. This paper will describe a case study in the use of 1, 1, 1-trichloroethane (methyl chloroform) and steps implemented in the reduction of wastes generated from using this commonly used solvent. This paper will review a specific case in the area of waste minimization that the world's largest telecommunications cable manufacture plant has implemented in order to reduce and minimize the generation of manufacturing by-products.

Recycling of Methyl Chloroform

In the manufacturing of copper telecommunications cable, methyl chloroform is used in the final stages for cleaning/removing a waterproofing material (approximately 1.5 feet of cable) from inside the cable, once the outer sheath has been removed, prior to final inspection. Vapor degreasers are used as the cleaning receptacle for the cable ends. The units heat the cleaning solvent (methyl chloroform) into which the conductors are immersed while a thermostatically controlled refrigeration unit provides a cold blanket of air in the tank area covering the solvent to minimize solvent vapors from leaving the degreaser.

The immersion of cables ends into the vapor degreasers produced a solvent that was unusable at the end of an 8-hour shift requiring the degreasing units to be cleaned after each shift of a 3-shift operation. This resulted in an annual usage of 50,300 gallons of solvent at a cost of $4.03 per gallon ($202,709.00 per year). The dirty solvent was then sold to a solvent reclamation company for $0.275 per gallon ($13,833.00). This resulted in a net expense of $188,877.00 per year.

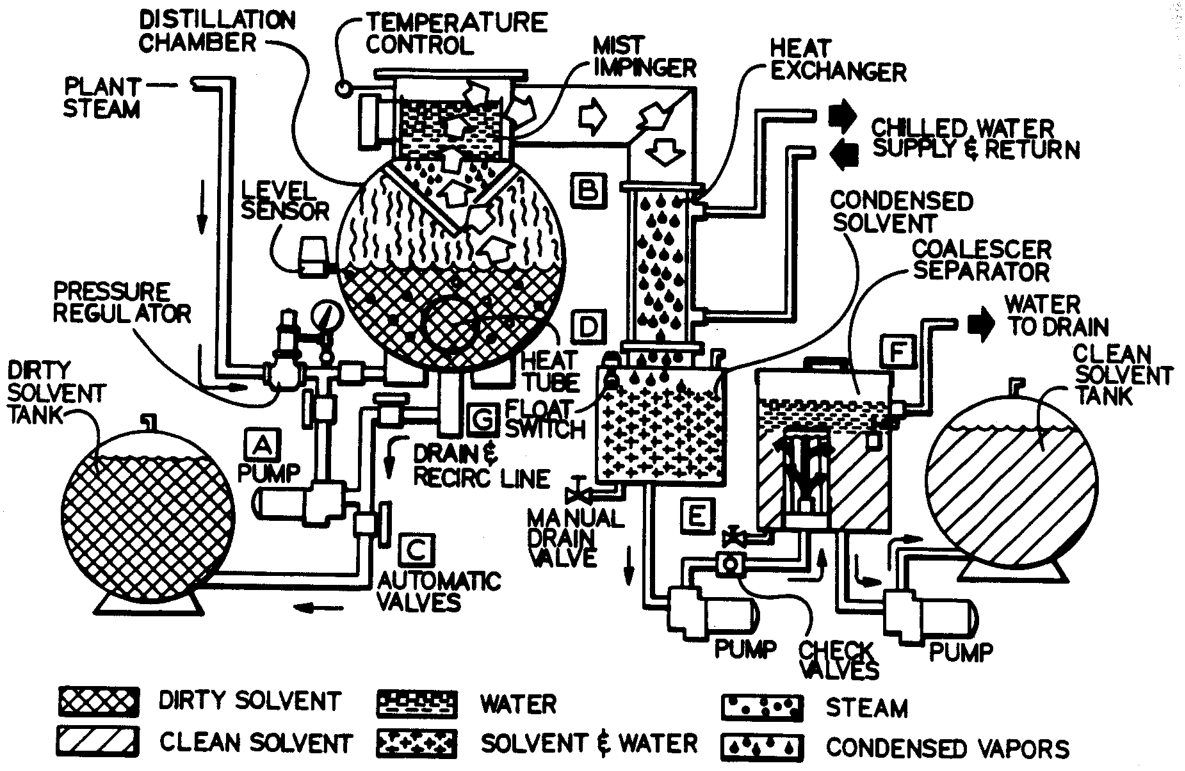


FIGURE 1

Flow Diagram of Solvent Recovery System

A. A reclamation cycle begins as the distillation chamber is filled with dirty solvent accompanied by the injection of the live steam or heat tube convection heat.

B. Vaporization of the solvent occurs in the distillation chamber.

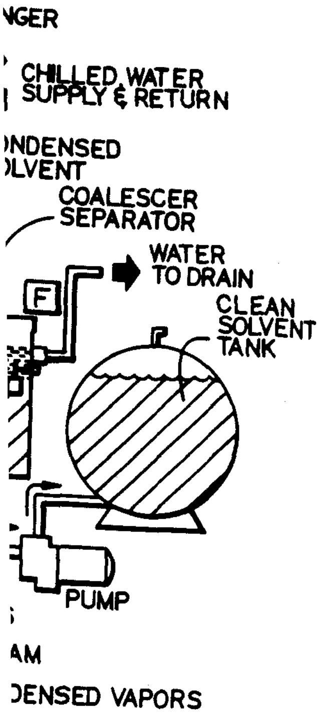
C. The solvent batch is recirculated through the feed/recirculating pump to increase BTU transfer and to suspend particulate matter.

D. The distillate vapors are condensed through a water-cooled heat exchanger.

E. The condensed solvent and water mixture is collected in a transfer tank and then pumped to the separator.

F. The solvent and water are separated with the water being drained while the solvent is pumped to the clean solvent tank.

G. When all the solvent has been distilled from the distillation chamber, drainage of sludge residue occurs automatically.



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The above process brought into focus several conditions which needed to be addressed. These are listed below.

- life-time of solvent
- material handling
- liability due to solvent reclamation company handling waste solvent.

In order to address these issues, it was decided that on-site reclamation of the solvent using a closed loop approach would be the most acceptable method (Figure 1).

The Solvent Recovery System employed utilizes live steam or convection distillation techniques. Dirty solvent is heated by its exposure to live steam or convective heat from the heat tube unit causing vaporization of the solvent. The distillate vapors are condensed through a water-cooled heat exchanger. The condensed solvent and water mixture is collected in a transfer tank and pumped to the coalescer separator. The solvent and water are separated with the distilled water being drained and the reclaimed solvent being pumped to the clean solvent tank. Sludge (waterproofing material, residual solvent, less than 0.1 percent, dirt, etc.) is discharged out of the distillation chamber through a drain at the end of each batch operation, into a sludge tank. In order to minimize any potential for environmental contamination, the distilled water from the coalescer separator is also discharged into the sludge tank. The sludge (including the distilled water), which at room temperature is a semi-solid, is pumped into fiber drums, and then incinerated in a rotary-type kiln incinerator by a company/government approved facility.

The Solvent Recovery System is connected to the vapor degreaser units via copper pipes which collectively drain into the dirty solvent tank prior to distillation. The clean solvent is pumped via copper pipe, to the degreasing units for continued use, making this a closed loop system. It must also be mentioned that during this process acid acceptance test procedures are employed to monitor solvent deterioration, which will also prevent equipment deterioration.

Upon installation of the Solvent Recovery System, the annual solvent usage rate decreased from 50,300 gallons per year to 9,790 gallons per year (81% decrease in solvent usage). This decreased the yearly solvent cost rom $202,206.00 to $39,356.00. The cost of incineration of the sludge that is generated from this process has averaged $15,531.00 per year.

The capital investment and development costs were recovered within the first year of operation. Thus, this project increased solvent life, decreased material handling, and minimized waste production.

Another important safety consideration related to the use of such a solvent recovery system is the avoidance of any aluminum parts within the system, such as pumps, heaters, filters, regulators, valves, and tanks. Aluminum is a reactive metal and is an unsuitable construction material for handling chemicals such as methyl chloroform and other halogenated hydrocarbon solvents.

REFERENCES

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